

Here's How Steel Wool Burns (and Why It Looks Like the Death of Krypton)

By [Jesse Emspak - Live Science Contributor](#) October 24, 2017

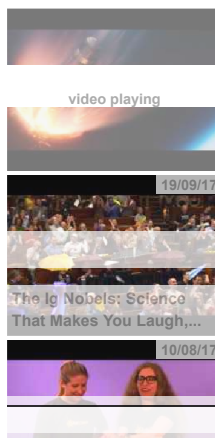
That scratchy steel wool that cleans up your grimy pans is more than hardworking; it is absolutely magnificent when lit on fire, as Reddit user ChazDodge showed in a recent video that makes the wiry, burning puff look like the death of the planet Krypton.

Though it's not an explosion caused by a nuclear chain reaction — à la Krypton — the light show created by [the burning steel wool](#) results from high-speed oxidation.

Here's how it works: Anytime something burns, you're seeing [oxidation](#). That means an atom, molecule or ion loses one or more electrons. Rust, for example, occurs when oxygen hits [iron](#), and in the process the iron loses electrons and forms iron oxide. Rusting is a slow version of the reaction seen in the Reddit post of the burning (oxidizing) metal strips that make up steel wool. [[Can Humans Spontaneously Combust?](#)]

Yet, we use our stainless steel (which contains iron) cooking utensils without expecting them to burst into flame from an errant spark. What gives?

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The reason a block of iron like a utensil doesn't catch fire is that the surface area is small, relative to the volume, Jason Benedict, an associate professor of chemistry at the University at Buffalo, told Live Science. Rusting iron actually generates some heat in the reaction, but it's a very small amount. In addition, a big block of iron can absorb and dissipate a lot of that heat energy before the block's temperature goes up. (You can see this effect in heating a metal spoon when stirring boiling pasta — a small one very quickly gets too hot to hold, while a bigger spoon takes longer.)

Steel wool, on the other hand, is made of lots of thin strands, and so a lot more iron atoms are in contact with the oxygen in the air. When you add heat (as from a flame), you add energy to the iron, and that makes the iron more likely to react with [other elements](#).

"When you're adding heat, you're overcoming an energy barrier to make the reaction happen faster," Benedict said. Once that reaction gets going, and because it generates heat itself, it heats neighboring atoms. In a block of iron, the heat gets dissipated to many other iron atoms. But in a thin fiber of iron, there's less solid material to absorb it (air absorbs heat, but much more efficiently than [solids](#)), so it keeps burning. The product of the burn is bits of rust, or iron oxide, just as the product of burning wood is black ash (or carbon).

Contact with oxygen is crucial to how fast and how hot the iron in steel wool burns — a pure-oxygen environment makes the flames a lot hotter, and the iron burns faster. (While steel wool is often covered in other chemicals — powdered soap, for example — only the iron is burning and mixing with oxygen.)

Air is only 20 percent or so oxygen, so the burning happens at a kind of half-speed that looks like a cartoon dynamite fuse. That's what's happening in the video — there's enough oxygen to burn the iron, but not enough to get it to burst into flame all at once. Again, one can draw an analogy with wood: Blow on a small flame and the extra oxygen can make the wood burn faster, while if you close the vents on an old-fashioned wood stove, the fire dies down to glowing embers and burns more slowly.

This is also why powdered metals burn easily and so are used in welding. Thermite is a good example — thermite is a mix of iron and aluminum powder that when heated enough will start reacting with oxygen and burning at a high temperature — enough to melt metal and weld. Thermite also shows up on the Fourth of July — it's an ingredient in the stuff that coats sparklers.

Editor's Note: *This article was updated to indicate that oxidation is the loss of electrons, not the gaining of oxygen as had been stated previously.*